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UVULOPALATOPHARYNGOPLASTY COMBINED WITH RADIOFREQUENCY TONGUE BASE REDUCTION AS ONE STAGE MULTILEVEL SURGERY FOR THE TREATMENT OF OBSTRUCTIVE SLEEP APNEA SYNDROME

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Abstract

In this study we investigated the outcome of uvulopalatopharyngoplasty combined with radiofrequency thermotherapy of the tongue base in patients with obstructive sleep apnea syndrome with both palatal and retrolingual obstruction.

A retrospective cohort study was performed in patients with mild to severe obstructive sleep apnea syndrome. Thirty-two patients (26 men and 6 women) with obstructive sleep apnea syndrome who underwent radiofrequency tongue base reduction combined with uvulopalatopharyngoplasty completed this study. The ages ranged from 28 to 56 years (mean age ± SEM: 45 ±5.87). All of the preoperative examinations and the measurements including the body mass index, visual analogue scoring system for snoring, Epworth sleepiness scale and polysomnography were repeated 6 months after surgery. Surgical success was defined as Apnea Hypopnea Index was less than 20, and the number of operated patients with such index was more than 50%, and response rate to the reduction of the index ranges between 20%-50%. The overall response rate was defined when reduction in Apnea Hypopnea Index was more than 20%.

Body mass index was not changed significantly before (26.72±4.15 kg/m^2) and after surgery (26.56±4.18 kg/m^2). Objective success defined as a reduction of Apnea Hypopnea Index by ±50% and Apnea Hypopnea Index < 20 was obtained in 29 out of 32 patients (90.6%). Mean Apnea Hypopnea Index decreased from 48.6±7.13/hour to 11.45±4.86/hour ($p<0.05$) and mean reduction rate of Apnea Hypopnea Index was 76.8±8.35% for all 32 patients, 80.2 ± 6.05% in patients with M. Friedman's anatomical stage II and 70.23±8.45% with III stage ($p<0.05$ for both). The mean snoring sound decreased significantly from 7.37±0.87 to 2.18±1.03 at 6th month after surgery ($p<0.05$). The mean value for Epworth sleepiness scale was significantly decreased from 11.8±2.05 to 5.7±1.32 in 6 months after surgery ($p<0.05$).

Single-session radiofrequency tongue base reduction combined with uvulopalatopharyngoplasty is an effective treatment for reducing symptoms and Apnea Hypopnea Index in obstructive sleep apnea syndrome patients with multilevel obstruction. It is also a safe treatment because of minimal postoperative morbidity and complication. The presented method of uvulopalatopharyngoplasty for the surgical treatment of obstructive sleep apnea syndrome patients is a new concept, which ensures an enlarged velopharyngeal space and prevents sleep obstruction of upper airways.

Keywords: *snoring, apnea, uvulopalatopharyngoplasty, radiofrequency, tongue base reduction*

Introduction

Obstructive sleep apnea syndrome is a very frequent and increasingly recognized major health problem [*Flemons W, 2002*]. This syndrome is associated with significant morbidity, mortality, and cost to society as a result of a two folds to seven folds increased risk of motor vehicle accidents [*Young T et al., 1997*] and may also result in cardiovascular diseases, quality of life deficits and performance deficits from loss of alertness [*Valencia-Flores M et al., 1996; Flemons W, Tsai W, 1997; Peker Y et al., 2002; Zelveian P et al., 2002*].

Nasal continuous positive airway pressure is considered the gold standard for the primary treatment of moderate to severe obstructive sleep apnea

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syndrome [*Jenkinson C et al., 1999*]. However, the therapeutic use of nasal continuous positive airway pressure is seriously limited by low long-term compliance [*Meurice J et al., 1994*]. The surgical approach is still the most common treatment method of obstructive sleep apnea syndrome, and varieties of surgical techniques have been well-described to manage the syndrome. Uvulopalatopharyngoplasty and radiofrequency-induced thermotherapy of the soft palate have been widely used for the treatment of velopharyngeal obstruction in obstructive sleep apnea syndrome [*Fujita S et al., 1981; Powell N et al., 1998*]. Currently there are available tongue base procedures as well that alleviate obstruction of the lower pharynx include mandibular osteotomy with genioglossus advancement, maxillomandibular advancement [*Li K et al., 2000*], partial midline tongue resection, and hyoidthyroidpexia (or hyoid suspension) [*Riley R et al., 1994; Den Herder C et al., 2005*]. These invasive approaches, especially maxillomandibular advancement, can be very effective in treating severe obstructive sleep apnea syndrome. However, above techniques require general anesthesia, longer hospitalization, and appear to result in a higher postoperative morbidity, thus, they are usually applied for severe obstructive sleep apnea syndrome only. For mild to moderate obstructive sleep apnea syndrome, these procedures are too extensive, and there is a need for less invasive procedures in case of mild pathology.

Tissue volume reduction of the tongue base with radiofrequency-induced thermotherapy was first introduced as a minimally invasive technique of sleep-disordered breathing by N. Powell and co-authors in 1999. Several studies showed improvement in objective and subjective features of obstructive sleep apnea syndrome [*Powell N et al., 1999; Nelson L, 2001; Woodson B et al., 2001; Stuck B et al., 2002; Friedman M et al., 2003; Steward D, 2004; Stuck B et al., 2005*]. The therapeutic effect of submucous coagulation is thought to imply volume shrinkage, but two MRI studies showed different outcomes. Powell N. and co-authors (1999) found a mean reduction in tongue volume by 17%, with a maximum of 29%. Stuck B. and co-authors could not verify a reduction in tongue volume or an increase in retrolingual space [*Stuck B et al., 2005*].

The multilevel pharyngeal surgery is required to overcome collapse at multiple levels of the pharyngeal airway. In this study, we present our results of single-session radiofrequency tongue base reduction combined with uvulopalatopharyngoplasty for the treatment of obstructive sleep apnea syndrome patients with multilevel obstruction.

MATERIAL AND METHODS

The study was conducted collaboratively at the ENT Department of "Erebouni" Medical Center, Yerevan, Armenia and "Sleep laboratory" of the "Center of Preventive Cardiology", Yerevan, Armenia, between 2012 and 2015.

Thirty-two patients with obstructive sleep apnea syndrome (both with velopharyngeal and retro lingual collapses) were involved in the study (age ranged from 28 to 56 years, 26 men and 6 women). No patient had previous velopharyngeal or lingual surgery. Patients were evaluated preoperatively and 6 months postoperatively by history taking, physical examination, fiberoptic nasopharyngoscopy and polysomnography. Retropalatal and retrolingual obstructions were determined by physical examination and observed by sleep endoscopy with midazolam. Patients with only single-level retropalatal obstruction or with only retrolingual obstruction were excluded from the study. All patients with multilevel obstruction underwent one-stage radiofrequency tongue base reduction combined with uvulopalatopharyngoplasty. The study was approved by our institutional review board.

Selection criteria for the proposed treatment included significant symptoms of snoring, excessive daytime somnolence, and an Apnea Hypopnea Index of greater than 15. The mean reduction rate of Apnea Hypopnea Index was calculated by following formula:

Physical examination: All patients underwent a full head and neck examination. The body mass index (BMI), a rank for obesity and an important criterion for obstructive sleep apnea syndrome, was calculated by dividing weight (*kg*) by the square of height (m^2). The staging system was based on both Friedman palate position score and tonsil size [*Friedman M et al., 2004*]. Tonsil size was graded from 0 to 4 (Fig. 1). The Friedman palate position was graded from 1 to 4 (Fig 2). Stage I was defined as those patients with palate position I or II, tonsil size 3 or 4 and BMI of less than 40. Stage II was defined as palate position I or II with tonsil size 0, 1 or 2 or palate position III and IV with tonsil size 3 or 4 and BMI of less than 40. Stage III was defined as palate position III or IV

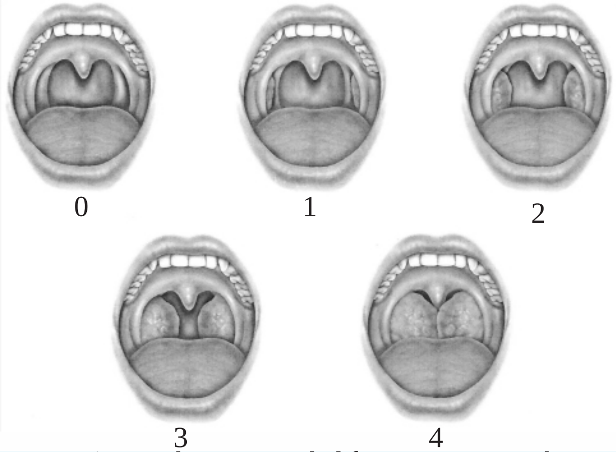

FIGURE 1. Tonsil size is graded from 0 to 4. Tonsil size 0 denotes surgically removed tonsils. Size 1 implies tonsils hidden within the pillars. Tonsil size 2 implies the tonsils extending to the pillars. Size 3 tonsils are beyond the pillars but not to the midline. Tonsil size 4 implies tonsils extend to the midline [Friedman M. et al., 2004]

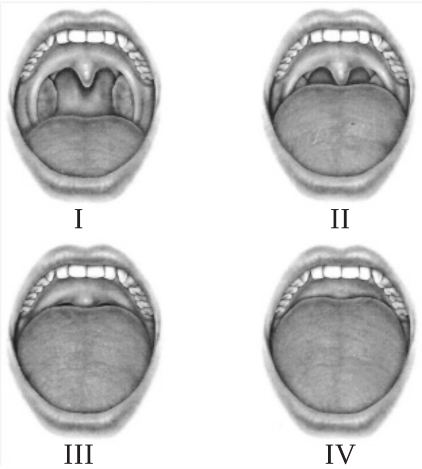

FIGURE 2. The Friedman palate position is based on visualization of structures with the mouth open widely without protruding the tongue. Palate grade I allows the observer to visualize the entire uvula and tonsils. Grade II allows visualization of the uvula but not the tonsils. Grade III allows visualization of the soft palate but not the uvula. Grade IV allows visualization of the hard palate only [Friedman M. et al., 2004]

with tonsil size 0, 1 or 2 and BMI of less than 40. All patients with a BMI of greater than 40 were included in stage IV.

Uvulopalatopharyngoplasty combined with radiofrequency tongue base reduction was applied only for patients with obstructive sleep apnea syndrome stage II or III. Patients with stage I were excluded from the examination, because they have a higher than 80% success rate when treated with uvulopalatopharyngoplasty only [*Woodson B et al., 2001*].

All of the preoperative examinations and the measurements including the BMI, visual analogue scoring system (VAS) for snoring, Epworth sleepiness scale and polysomnography were repeated 6 months after the surgery. Surgical success was defined as Apnea Hypopnea Index was less than 20, and the number of operated patients with such index was more than 50%, and response rate to the reduction of the index ranges between 20%-50%. The overall response rate was defined when reduction in Apnea Hypopnea Index was more than 20%.

Severity of snoring was determined by VAS, graded from 0 to 10 preoperatively according to what the subject's bed partner reported [*Bassiouny A et al., 2007*] (Table 1).

Overnight polysomnography was performed in all patients with "EMBLA N7000" (EMBLA System, Inc., USA) polysomnograph, using the program "Somnologica v. 4.0" (EMBLA System, Inc., USA). The monitoring included electroencephalogram (C3/A2, C4/A1 of the international electrode placement system), electrooculogram, chin and leg electromyogram, and electrocardiogram (modified V-2 lead). Respiration was investigated by oronasal airflow (thermal sensors), thoracic and abdominal movements (piezo sensors), snoring sound (microphone), and oxygen saturation (pulse oximetry). Records were scored following the A. Rechtschaffen and A. Kales international criteria for sleep/wake determination [*Rechtschaffen A, Kales A, 1968; AASM Task Force, 1999*].

As the most important parameters for determination of obstructive sleep apnea syndrome, we chose Apnea Hypopnea Index during sleep. Simple snoring, central sleep apnea syndrome, narcolepsy, restless leg syndrome, and so on, were identified and excluded by polysomnography.

TABLE 1

Visual analogue scoring system for snoring

Points	Types of snoring
0	No snoring at all
1-3	Soft snoring not interrupting the bed partner's sleep
4-6	Loud snoring, enough to be bothersome to the partner
7-9	Very intense snoring annoying to anyone nearby
10	Bed partner leaves room

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Excessive daytime sleepiness was measured using Epworth sleepiness scale.

Statistical analysis: Dispersion analyses with parametric and nonparametric criteria using the GRAPH PAD PRISM5 were used in this study. Results of independent experiments was used to calculate mean values ± standard errors of means (SEM), and differences were defined as statistically significant by Student's t-test, p≤0.05.

Uvulopalatopharyngoplasty: Uvulopalatopharyngoplasty was carried out according to Ichiro Komada's technique [*Komada I et al., 2012*] plus radiofrequency volumetric tissue reduction of middle part of soft palate, along the uvula. The mucosa of the soft palate was removed along with the anterior pillar. After tonsillectomy the preserved posterior pillar of pharynx was pulled upward, until the upward margin reached 2 *cm* below the edge of the hard palate and the root of the posterior pillar was cut along with adjacent palatopharyngeal muscles to reduce tension on the mucosa. Mattress sutures were used to avoid irregular scar formation. At the end of uvulopalatopharyngoplasty the radiofrequency volumetric tissue reduction of middle part of soft palate was used for stiffening of soft palate. The surgical areaways infiltrated with 1% lidocaine with 1:100.000 adrenaline and the radiofrequency needle device were activated after the instrument tip was placed into the palatal muscles along the length of uvula and each site was treated with a 13 *W* power. Surgitron (Ellman, USA) was activated for 15-20 seconds.

Tongue base reduction: Temperature-controlled radiofrequency volume tissue reduction of the tongue base was performed using Surgitron Dual-Frequency IEC-II 4.0 *MHz*. Because the initial procedure was combined with uvulopalatopharyngoplasty, general anesthesia was required.

The anterior tongue was held forward with gauze, and the midline just anterior to the circumvallate papillae was clearly marked with a pen to avoid treatment more than 1 *cm* away from the midline. The midline of the tongue and the junction of the middle third and tongue base were identified and marked.

The surface of the tongue was disinfected with 0.5% chlorhexidine. A mixture of normal saline and 1% lidocaine with 1:100.000 epinephrine was infiltrated around the middle of the circumvallate papillae to enhance the effect of radiofrequency. From six to nine application sites were selected. Energy was delivered with an exclusive needle device through the dorsal surface of the tongue. Three lesions were at the midline of the circumvallate papillae and 1 *cm* anterior and posterior to the middle of the circumvallate papillae. The next six lesions were 1 *cm* right and left of the first three lesions (Fig. 3). A power setting on the power control unit was 35 *W* (as recommended by the instruction of device). The probe at each application site was inserted perpendicularly at depth of 1.5 *cm*. The application time varied between 20 and 25 *s* per puncture and was terminated by acoustic "end-indication". Each site received 700 to 875 *J* per punctum. The total amount of energy delivered to the tongue base was depended on the size of tongue and on the number of lesions and varied between 4200 to 7875 *J*.

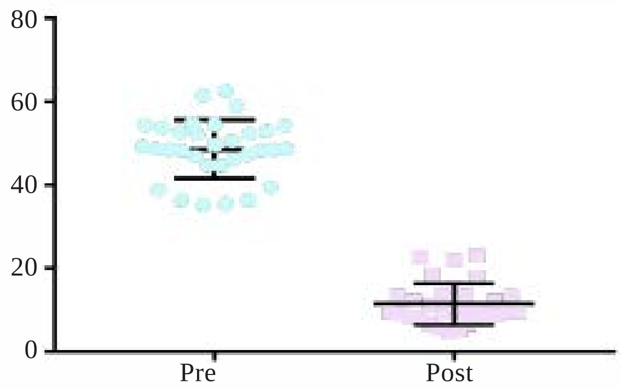

FIGURE 3. *Apnea Hypopnea Index change before and after surgery*
Note: *All data represent means ± SEM and are significantly different at Pt <0.05 (*) comparing post with pre.*

All patients received antibiotics intravenously for 2 days postoperatively and then orally for 1 week. Oral painkillers and steroid were administered routinely. Patients were usually discharged after 2 days of surgery. After operation the patients continued using of continuous positive airway pressure for at least 8 to 10 days after surgery with the help of a nasal mask.

RESULTS

Thirty-two patients (26 men and 6 women) with obstructive sleep apnea syndrome who underwent Single-session radiofrequency tongue base reduction combined with uvulopalatopharyngoplasty completed this study. The ages ranged from 28 to 56 years (mean age ± SEM: 45±5.87). No postoperative complications such as infections, abscesses, haematomas or airway obstruction occurred. One patient had an ulceration of the tongue base that resolved within 1 week and another one complained of slight difficulty swallowing for a week after surgery. Two patients complained of a taste change that resolved within from 2 to 2.5 months. None of the 32 cases showed stenosis of the nasopharynx, dysphagia or globus sensation.

BMI was not changed significantly before (26.72±4.15 *kg/m²*) and after surgery (26.56±4.18 *kg/m²*). Twenty-one patients were classified as stage II and eleven patients as stage III according to the Friedman staging system. Objective assessment of the patients was carried out preoperatively and at 6 months postoperatively (Table 2).

Objective success defined as a reduction of Apnea Hypopnea Index by ±50% and Apnea Hypopnea Index < 20 was obtained in 29 of the 32 patients (90.6%). Mean Apnea Hypopnea Index decreased from 48.6±7.13/*hour* to11.45±4.86/*hour* (p<0.05) (Fig. 3) and mean reduction rate of Apnea Hypopnea Index was 76.8±8.35% for all 32 patients, 80.2 ±6.05% in patients with Friedman's anatomical stage II and 70.23±8.45% with stage III (p<0.05 for both). Significant differences were observed within each of these groups.

All data represent means ± SEM and are significantly different at Pt <0.05 (*) comparing post with pre.

The mean snoring sound decreased significantly from 7.37±0.87to 2.18±1.03 at 6th month after surgery (p<0.05) (Fig. 4). In patients with Friedman's anatomical stage II group, 23.8% of 21patients had moderate, and 76.2% – severe snoring. The mean VAS for snoring in patients of that group was 7.28±0.96 preoperatively and 2.05±1.02 (p<0.05) in the last visit (6 months postoperatively). Snoring was completely disappeared in 6 patients (28.6%), and satisfactory improvement (soft snoring not interrupting the bed partner's sleep) was reported by 13 patients (61.9%) in the postoperative period. Two (9.5%) patients' bed partners noted some but not satisfactory decrease of sound snoring.

In the patients with Friedman's anatomical stage III group, 1 of 11 patients had moderate, and the ramening 10 – severe snoring. The mean VAS for snoring in patients of that group was 7.54±0.82 preoperatively and 2.45±1.03 (p<0.05) in the last visit (6 months postoperatively). Snoring was completely disappeared in 3 patients (27%), and satisfactory improvement was reported by 7 patients (64%) in the postoperative period. 1 patients' bed partners noted some decrease of sound snoring, but unsatisfactory of results.

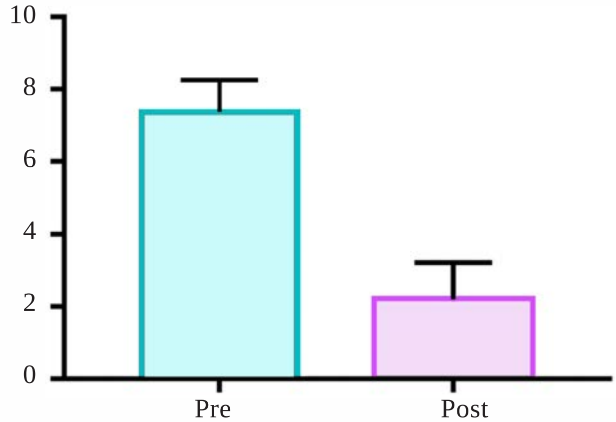

FIGURE 4. *Pre- and postoperative snoring scale score*
Note: *All data represent means ± SEM and are significantly different at Pt <0.05 (*).*

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Postoperative values for ESS significantly reduced after the treatment for both stage II and III patients. In patients with Friedman's anatomical

TABLE 2

Outcome for 32 patients as classified by Friedman's anatomical stage

	II stage (n=21)		III stage (n=11)		Total (n=32)	
	Pre	Post	Pre	Post	Pre	Post
Body mass index	25.2±4.13	24.9±4.06	29.6±2.34	29.6±2.45	26.72±4.15	26.56±4.18
Apnea Hypopnea Index	47.4±6.77	9.5±3.77	50.8±7.57	15.1±4.75	48.6±7.13	11.45±4.86*
Epworth sleepiness scale	11.14±1.87	5.4±1.35	13.09±1.81	6.4±1.03	11.8±2.05	5.7±1.32*
Snoring	7.3±0.9	2.1±1.02	7.5±0.82	2.4±1.03	7.4±0.87	2.2±1.03*

Note: *All data represented by means ± SEM and are significantly different at Pt<0.05 (*).*

stage II the index of Epworth sleepiness scale was decreased from 11.14±1.87 to 5.38 ±1.35 and in patients with stage III – from 13.09±1.81 to 6.36±1.03 ($p<0.05$ for both).

The mean value for Epworth sleepiness scale was significantly decreased from 11.8±2.05 to 5.7±1.32 at 6 months after surgery ($p<0.05$) (Fig. 5).

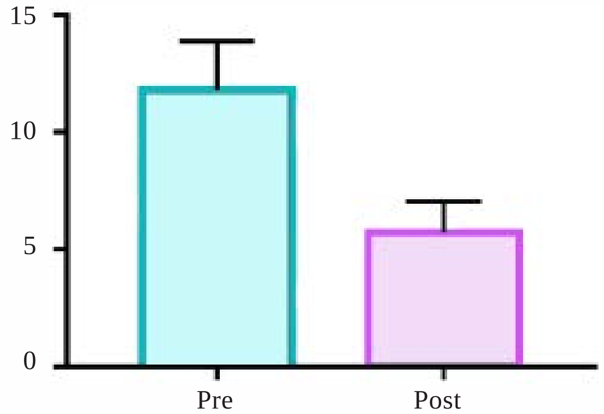

FIGURE 5. Pre- and postoperative Epworth sleepiness scale score

Note: *All data represent means ± SEM and are significantly different at Pt <0.05 (*).*

DISCUSSION

Successful treatment of obstructive sleep apnea syndrome requires normalization of polysomnographic results. There is an opinion that subjective improvement of patients' symptoms often does not correlate well with objective measurements [*Stuck B et al., 2002*]. Therefore, evaluation of level the airway obstruction and assessment of multilevel pharyngeal surgery for overcoming collapse at multiple levels of the pharyngeal airway is very important.

Our study shows that combined treatment including uvulopalatopharyngoplasty and RFTBR as a treatment method for patients with both palatal and retrolingual obstructions is highly effective in eliminating symptoms that most often make the patients to seek treatment. Specifically, 87.5% of our patients had significant reduction of snoring levels and all of the patients noted subjective reduction of day time somnolence.

Tongue base reduction with temperature-controlled radiofrequency has been searched by some authors. Li et al. [*Li K et al., 2002*] evaluated the long-term outcomes (28 months) of radiofrequency tongue base reduction in patients with obstructive sleep apnea syndrome as an alternative method. They found an improvement in the apnea index but worsening of hypopnea index. The success of radiofrequency tongue base reduction may diminish with time. Some authors reported no significant change in respiratory disturbance index but improvement in snoring and daytime sleepiness after radiofrequency tissue reduction [*Stuck B et al., 2002*]. Sher A. and co-authors (1996) reported previously that a patient population without tongue based obstruction demonstrated a 42% uvulopalatopharyngoplasty success rate. The success rate was 5% in patients with tongue base obstruction [*Sher A et al., 1996*]. The other authors reported that 20% of obstructive sleep apnea syndrome patients responded to radiofrequency volumetric tissue reduction in a multi-institutional study [*Woodson B et al., 2001*]. Fischer Y. and co-authors [*Fischer Y et al., 2003*] reported that 33% of patients were treated successfully by multilevel temperature-controlled radiofrequency therapy. Stuck B. and co-authors (2003) and D. Steward (2004) demonstrated success rates of multilevel radiofrequency surgery in 33 and 59% of patients, respectively. Nelson L. combined two subsequent radiofrequency tongue base reduction with uvulopalatopharyngoplasty in patients with multilevel obstruction and had an improved response rate (50% success rate) [*Nelson L, 2001*]. In our study, objective success, as evaluated by a reduction in Apnea Hypopnea Index of ±50% and Apnea Hypopnea Index <20, was obtained in 29 of the 32 patients (90.6%). Authors reported that uvulopalatopharyngoplasty demonstrated a success rate of 37.9% in Friedman stage II patients and 8.1% in stage III patients and in stages II and III patients treated with uvulopalatopharyngoplasty plus tongue base radiofrequency reduction, success rates were 74.0 and 43.8%, respectively [*Friedman M et al., 2003*]. Among these patients 59.3% were operated upon with one time tongue base radiofrequency reduction, with the others receiving a maximum of six procedures. In our study, the success rate was 80% and 70% in stage II and III patients, respectively.

Most frequent complications after uvulopalatopharyngoplasty in patients with obstructive sleep apnea syndrome are the velopharyngeal insufficiency, dysphagia, persistent dryness, globus sensation, nasopharyngeal stenosis. All these side effects are reportedly seen from 10% to 58% of patients with this syndrome postoperatively and the main reason of these complications is the "excessive resection" technique, in which the uvula, part of the soft palate and lateral pharyngeal walls are excised [*Fairbanks D, 1990; Haavisto L, Suonpää J, 1994; Kezirian E et al., 2004; Randerath W et al., 2011*].

The most important concept in our method of surgery is to preserve the uvula and leave the middle soft palate intact. The lateral pharyngoplasty described by M. Cahali (2003) preserves the middle soft palate, and established a 53% success rate in 15 patients as evaluated by an Apnea Hypopnea Index reduction of 50% and Apnea Hypopnea Index < 20. Mean Apnea Hypopnea Index decreased from 41.6 to 15.5 after surgery. Cahali M. cut the uvula at the tip, risking a single-line scar. He also cut the palatopharyngeal muscles at the top of the muscle, instead of at the root. A revised uvulopalatopharyngoplasty has also been reported by Han D. and co-authors (2005), yielding a 69.1% success rate in 68 patients with mild with obstructive sleep apnea syndrome. Mean Apnea Hypopnea Index decreased from 32.1 to 12.7 after surgery. Han emphasized the important functions of the uvula in deglutition, respiration, speech, and pharyngeal airway dilatation. Preservation of the uvula in the uvulopalatopharyngoplasty of D. Han may effectively avoid the postoperative complications of classic uvulopalatopharyngoplasty. However, he has removed the redundant adipose tissue and surplus mucous membrane along the uvular muscles. The uvulopalatopharyngoplasty without uvulotomy is also effective and reduced Apnea Hypopnea Index to <5 in all five patients [*Kamizaki Y, 2005*]. To prevent soft palate insufficiency, Y. Kamizaki preserved the uvula intact in uvulopalatopharyngoplasty.

In this study, none of patients displayed nasopharyngeal stenosis, velopharyngeal insufficiency, dysphagia, persistent dryness and globus sensation in 6 months follow-up period after surgery.

Due to this technique of uvulopalatopharyngoplasty combined with radiofrequency tongue base reduction we obtained a high success rate (90.6%) results after surgery. The mean reduction of Apnea Hypopnea Index was from 48.6±7.13 to 11.45±4.86. According to Friedman's anatomical stage, the Apnea Hypopnea Index decries from 47.4±6.77 to 9.4±3.77 for patients with stage II, and from 50.8±7.57 to 15.1±4.75 for stage III. Excessive obesity reduces surgical effects and increases operative risk.

Our study has several limitations. First, there was no control group in our study. Because of its retrospective nature, we did not compare classic uvulopalatopharyngoplasty combined with radiofrequency tongue base reduction and introduced the modification of this method in combination with radiofrequency tongue base reduction. Thus, a prospective randomized controlled trial is needed in future to validate our outcomes. Second, there was no long-term follow-up data to enable evaluation of delayed postoperative complications, and possible symptom changes. Third, the number of enrolled patients was small enough to confer strong statistical reliability. This study excluded patients who had refused follow-up sleep investigations. Many patients showed no interest to perform follow-up polysomnography, mainly due to cost concerns. In addition, in Armenia, sleep studies are not supported by the national health insurance system. As such, the status of patients who refused to be followed-up with sleep studies remains unknown.

To receive more information whether or not adding radiofrequency tongue base reduction to uvulopalatopharyngoplasty is successful in multilevel obstruction (both palatal as retrolingual) patients in mild to moderate with obstructive sleep apnea syndrome, more research will be necessary. Ideally this would be a prospective, randomized trial, with larger treatment groups, including an optimal additional treatment of radiofrequency tongue base reduction.

Conclusion

Single-session radiofrequency tongue base reduction combined with uvulopalatopharyngoplasty is an effective treatment for reducing symptoms and apnea-hypopnea index in with obstructive sleep apnea syndrome patients with multilevel obstruction. It is also a safe treatment because of minimal postoperative morbidity and complication. Radiofrequency tongue base surgery has been described by researches, how showed the advantages of this procedure as being simple and short time technique. It could be considered first treatment for with obstructive sleep apnea syndrome patients with multilevel obstruction, independent of the severity of the syndrome. The presented a method of the uvulopalatopharyngoplasty for the surgical treatment of patients with obstructive sleep apnea syndrome, is a new concept for the creation of separate right and left scars, leaving the middle soft palate intact. The intact middle soft palate and separated scars create a widened pharyngeal space while preserving the pharyngeal functions.

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